Claims:

1. An optical retro-reflective apparatus with modulation capability comprising:

a retro-reflecting Fabry-Perot structure including a pair of reflective surfaces; and

a micromechanical device for moving at least one of the reflective surfaces of said pair of reflective surfaces relative to another one of the reflective surfaces of said pair of reflective surfaces a distance which causes the pair of the reflective surfaces to switch between a reflective mode of operation and a transmissive mode of operation.

2. The apparatus of claim 1 wherein the retro-reflecting structure includes a corner cube arrangement with the pair of reflective surfaces forming at least one angled reflecting surface of the corner cube arrangement and another reflecting surface forming another angled reflecting surface of the corner cube arrangement.

3. The apparatus of claim 2 further including a detector disposed to receive an optical beam passing through the reflective surfaces when in said transmissive mode of operation.

4. The apparatus of claim 2 further including a detector disposed to receive an optical beam reflected from the reflective surfaces when the reflective surfaces are in said reflective mode of operation.

5. The apparatus of claim 1 wherein the micromechanical device is a MEM device made using photolithographic techniques.

6. An optical retro-reflective apparatus for modulating an optical beam, the apparatus comprising:

a retro-reflecting structure including a substrate and a moveable grating structure; and

a micromechanical device for moving the moveable grating structure relative to the substrate to cause the retro-reflecting structure to switch between a retro-reflective mode of operation and a non-retro-reflective mode of operation, the micromechanical device being responsive to a signal to impart modulation to an optical beam which is retro-reflected from the retro-reflecting structure.

7. The apparatus of claim 6 wherein the retro-reflecting structure includes a corner cube arrangement with said substrate and moveable grating structure forming at least a portion of one reflecting surface of the corner cube arrangement and at least another reflecting surface forming another reflecting surface of the corner cube arrangement.

8. The apparatus of claim 7 further including a detector disposed to receive a beam reflected from the substrate and moveable grating structure when the substrate and moveable grating structure are in said reflective mode of operation.

9. The apparatus of claim 7 wherein said one reflecting surface of said corner cube arrangement is pixelated by a plurality of moveable grating structures.

10. The apparatus of claim 9 wherein the gratings of one moveable grating structure of said plurality of moveable grating structures is rotated about a central axis thereof related to neighboring moveable grating structures.

11. The apparatus of claim 10 wherein the at least another reflecting surface has a moveable grating structure associated therewith which is responsive to said signal for imparting modulation to the optical beam that is retro-reflected from the retro-reflecting structure.

12. A method of retro-reflecting and modulating an optical beam comprising:

a. providing a retro-reflecting structure having at least one moveable optical element

for selectively reflecting the optical beam impinging the retro-reflecting structure, the moveable optical element having a first position in which the retro-reflecting structure retro-reflects the optical beam and having a second position in which the retro-reflecting structure does not retro-reflect the optical beam, the first and second positions being spaced by a distance less than a wavelength of the optical beam; and

b. moving said at least one moveable optical element in response to a modulation signal to thereby modulate the optical beam as a modulated retro-reflected beam.

13. The method of claim 12 wherein the retro-reflecting structure includes at least a pair of reflective surfaces, at least one of said reflective surfaces comprising the at least one optical element which is moved less than a wavelength of the optical beam in order to modulate the retro-reflected beam.

14. The method of claim 13 wherein the at least a pair of reflective surfaces are arranged in a cat's eye configuration.

15. The method of claim 13 wherein the at least a pair of reflective surfaces are arranged in a corner cube configuration with at least one mirrored surface.

16. The method of claim 12 wherein the retro-reflecting structure includes a substrate and a grating structure, at least one of said substrate and said grating structure comprising the at least one optical element which is moved less than a wavelength of the optical beam in order to modulate the retro-reflected beam.

17. The method of claim 16 wherein the substrate and grating structure are arranged in either a cat's eye or a corner cube configuration.

18. The method of claim 16 wherein the substrate and grating structure comprise multiple

substrate and grating structures arranged in corner cube configuration.

19. The method of claim 18 wherein the corner cube configuration has multiple reflective faces with each face comprising a plurality of grating structure pixels, with each pixel being rotated relative to a neighboring pixel.

20. The method of claim 12 wherein the retro-reflecting structure comprises a corner cube with multiple reflective faces, at least one of the multiple reflective faces having at least one grating structure which comprises the at least one moveable optical element.

21. The method of claim 20 wherein the at least one of the multiple reflective faces have a plurality of grating structures disposed in a grid and wherein neighboring ones of the grating structures in the grid have different grating periods.

22. An apparatus for retro-reflecting and modulating an optical beam comprising:

a. a retro-reflecting structure having at least one moveable optical element for selectively reflecting the optical beam impinging the retro-reflecting structure, the moveable optical element having a first position in which the retro-reflecting structure retro-reflects the optical beam and having a second position in which the retro-reflecting structure does not retro-reflect the optical beam, the first and second positions being spaced by a distance less than a wavelength of the optical beam; and

b. a micromechanical device for moving said at least one moveable optical element in response to a modulation signal to thereby modulate the optical beam as a modulated retro-reflected beam.

23. The apparatus of claim 22 wherein the retro-reflecting structure includes at least a pair of reflective surfaces, at least one of said surfaces including the at least one optical element which is moved less than a wavelength of the optical beam in order to modulate the retro-reflected beam.

24. The apparatus of claim 23 wherein the pair of reflective surfaces are arranged in either a cat's eye or a corner cube configuration.

25. The apparatus of claim 22 wherein the retro-reflecting structure includes a substrate and a grating structure, at least one of said substrate and said grating structure comprising the at least one optical element which is moved less than a wavelength of the optical beam in order to modulate the retro-reflected beam.

26. The apparatus of claim 25 wherein the substrate and grating structure are arranged in either a cat's eye or a corner cube configuration.

27. A retroreflector comprising a plurality of mirrored surfaces arranged orthogonally with respect to each other and wherein at least one of said mirrored surfaces is controllable for modifying the reflection characteristics of said at least one of said mirrored surfaces whereby a beam of light is retro-reflected by the retroreflector when said at least one of said mirrored surfaces is in a first light reflecting mode and wherein said beam of light is not retro-reflected by the retroreflector when said at least one of said mirrored surfaces is in a second light reflecting mode.

28. The retroreflector of claim 27 wherein said at least one of said mirrored surfaces has at least one retro-reflecting Fabry-Perot structure, the Fabry-Perot structure including: a pair of reflective surfaces and a micromechanical device for moving at least one of the reflective surfaces of said pair of reflective surfaces relative to another one of the reflective surfaces of said pair of reflective surfaces a distance which causes the pair of the reflective surfaces to switch between a reflective mode of operation and a transmissive mode of operation.

29. The retroreflector of claim 27 wherein said at least one of said mirrored surfaces includes

at least one structure comprising a substrate, a moveable grating structure and a micromechanical device for moving the moveable grating structure relative to the substrate to cause the at least one structure to switch between a retro-reflective mode of operation of the retroreflector and a non-retro-reflective mode of operation of the retroreflector, the micromechanical device being responsive to a signal to impart modulation to an optical beam which is retro-reflected from the at least one structure.

30. The retroreflector of claim 27 wherein said at least one of said mirrored surfaces includes a plurality of reflecting structures arranged in an array, the reflecting structures being responsive to a signal for causing the reflecting structures to switch between a retro-reflective mode of operation of the retroreflector and a non-retro-reflective mode of operation of the retroreflector, the micromechanical device being responsive to a signal to impart modulation to an optical beam which is retro-reflected from the at least one structure.

31. The retroreflector of claim 30 wherein the reflecting structures switch between a retro-reflective mode of operation of the retroreflector and a non-retro-reflective mode of operation of the retroreflector by tilting the reflecting structures arranged in said array.

32. The retroreflector of claim 27 wherein said at least one of said mirrored surfaces is a pixelated mirrored surface with individual MEMS devices for controlling individual mirrors disposed in an array which defines said pixelated mirrored surface.